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Cognitive Style Mapping as a Predictor of Student Success in a Radiologic Technology Program

Dorothy Ann Branham
Medical University of South Carolina

COGNITIVE STYLE MAPPING AS A PREDICTOR OF STUDENT SUCCESS IN A RADIOLOGIC TECHNOLOGY PROGRAM

by

Dorothy Ann Branham

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Approved by:

Karen B. Atkins
Chairman, Advisory Committee

Kenneth J. Buhmeyer

Grace Kobrick

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Utilization of cognitive styles in the educational process as a fundamental, useful, and effective tool has been implemented in many institutions, including Spartanburg Technical College. A research study was completed utilizing the Cognitive Style Map in an attempt to develop a cognitive profile of the successful Radiologic Technology student. An attempt was also made to predict the success of Radiologic Technology students by using the profile which was developed. A null hypothesis and an alternate hypothesis was proposed based on the scores of the twenty-eight symbols on the inventory. The scores on each symbol were statistically analyzed according to a frequency distribution, Pearson's Correlation Coefficient at the .05 level of significance, and t-tests also at the .05 level of significance. Based on the results of the statistical tests the null hypothesis was accepted. No cognitive profile could be developed because of the similarity of the cognitive maps studied. Two symbols, however, ethics and the capacity to judge social distance, did positively correlate with the successful students. These symbols can be of value to the student and the educator. Future research may lead to the development of more precise cognitive profiles for the Radiologic Technology students.

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I. INTRODUCTION

Efforts to improve the quality of education are not new ventures, but have been described in various histories of education which date back to the time of Confucius. Change and improvement has taken place ever since. With the impact of science and technology, search for improvement has been accelerated in the twentieth century. Teachers and students alike have witnessed the testing movement; the counseling movement; the curriculum reform movement and the team-teaching movement. The individualized instruction movement is a more recent attempt to improve the quality of education. K. Patricia Cross labeled the 1970's as the decade of the "instructional revolution" and has declared that the signs of the revolution are "proliferating like mushrooms after a spring rain."[1] These efforts and others have experienced some degree of success as well as frustration often leading to the non-acceptance of many fine ideas. The failure in the field of education to have an overall conceptual framework may have been the cause for these frustrations.[2]

In 1964 Joseph E. Hill introduced the Educational Sciences as a basic conceptual framework and scientific language for the applied field of education that approaches the level of precision found in such derivative fields as law, engineering, pharmacy, nursing and medicine. Articulation of problems and phenomena now have become possible in terms of the "sciences", and as a result, inadequate communication and resultant misinterpretation and fragmentation in the field of education are being alleviated. Hill made four assumptions in the process of creating and

developing these sciences. These assumptions are essential to the conceptual framework for education. They are as follows:[3]

1. Education is the process of searching for meaning.
2. Thought is different from language.
3. Man is a social creature with a unique capacity for deriving meaning from his environment and personal experiences through the creation and use of symbols.
4. Not content with biological statistics along, man continually seeks meaning.

The seven "sciences" introduced by Hill were:

1. symbols and their meanings,
2. cultural determinants of the meaning of symbols,
3. modalities of inference,
4. biochemical and electrophysiological aspects of memory,
5. cognitive styles of individuals,
6. teaching styles, administrative styles and counseling styles,
7. systemic analysis and decision making.

In an effort to break the lock-step of traditional education, Dr. Hill, President of Oakland Community College and Dr. Derek N. Nunney, Vice-President, created and introduced the Personalized Education Program utilizing the Educational Science of Cognitive Style. An individual's educational cognitive style is a description of the way he or she seeks meaning from the formalized structures of knowledge. The cognitive style of an individual encompasses numerous elements which have been used as the basic structures of the first five Educational Sciences. Hill and Nunney's concept allowed a greater personalization of instruction leading to successful achievement by students at all levels of educational development.

On the basis of numerous research studies, the determination and utilization of cognitive styles in the educational process as a fundamental, useful, and effective tool has been implemented in many institutions, including Spartanburg Technical College.[4] Mapping students'

educational cognitive styles presents the instructors with pictures of the variety of profiles the students use in pursuit of an education. This mapping process enables the instructors to identify specific strengths which can be used to develop educational prescriptions.

In an instructional setting, a cognitive style map can be as valuable a tool to a Radiologic Technology instructor as a patient's x-ray is to the medical doctor. The cognitive style map gives a picture of the way a student derives meaning from his environment and personal experience. It indicates how the student takes notice of his total surroundings, how he searches for meaning and how he contrasts or relates information. Through a careful analysis of this tool the student's strengths are emphasized and weaknesses are acknowledged, allowing a prescription of one or more alternative methods of instruction. Each individual has his own cognitive style of learning.

According to several authorities different occupations or careers also have different cognitive styles.[5] Many individuals in educational programs select a certain occupational area but become disinterested, discouraged, and eventually withdraw from the program because they find that it is not really what they had expected. Is it possible to predict the success of a Radiologic Technology student by comparing his cognitive style with the prescribed cognitive style for this occupation? This was the primary question of this study.

Statement of the Problem

Similar to most educational institutions in this era, the Radiologic Technology program at Spartanburg Technical College, in South Carolina, has had to deal with high attrition rates during the last few years. Historically, Allied Health programs have a thirty to fifty percent attrition rate. In reviewing the list of Radiologic Technology students in the last three years who failed to complete the twenty-four month course of study, the majority of dropouts occurred the first year, particularly during the first two quarters. A variety of reasons were given by these students for not continuing in the program. During the first quarter particularly, the main reason appears to be a lack of interest because the profession just was not what the student had expected. Another reason for dropping out is the lack of willingness to commit themselves to the busy schedule with which the students must cope. Other students were not able to deal with the close patient and physician relationships that the profession demands. A fourth reason dealt with family and marital problems. Academic failures are also included in the reasons for not completing the course.

New ideas to reduce the attrition rate in all divisions at Spartanburg Technical College are continually being reviewed. Several years ago Hill's concept of cognitive style mapping of students was implemented to aid instructors in determining their students' methods of learning. Since the implementation of this personalized instruction, the Radiologic Technology Department's attrition has not changed significantly, although the process has indicated to the instructors the need for a variety of instructional modes.

Other special efforts have been made in the Radiologic Technology

program to help reduce the number of dropouts. Careful screening of the applicants, applicant orientation to the hospital environment, and the development of a five member admissions committee are parts of the process utilized each year in accepting students into the program.

According to the literature, the results of a student's cognitive style map can be the basis for guiding the student toward an occupational area whose prescribed map closely matches the student's own cognitive style. If an effective prescribed map for the Radiologic Technology profession could be constructed and applicants could be mapped prior to acceptance into the program, perceived dropouts could be counseled before they commit themselves to the program. If the students were aware that another program was more suitable for them, they might reevaluate their reasons for choosing a particular course of study. In addition, if the student still desired to tackle the original program, he could be forewarned through special counseling of his weaknesses with the intent to augment his style. Through interaction with the instructor the student may overcome these weaknesses, thus increasing the likelihood of program completion.

Significance of the Problem

The Radiologic Technology program is not the only program at Spartanburg Technical College or in the State affected by high attrition rates. This topic is routinely discussed at state professional meetings and seminars by the other nine Radiologic Technology schools. Other allied health programs also find that they have a number of students who are unable to complete their course of work because of similar problems. Possible methods to reduce this problem should be continually

examined.

High attrition rates are not only a reflection of the educational institution, but on the student and profession as well. The instructors must account for their numbers of dropouts to both their institution and their accrediting agencies. They must look at themselves to determine if their mode of instruction is adequate for their students. The profession is also affected by large numbers of dropouts. There is presently a demand in the job market for all types of health career professionals. The impact of dropouts is particularly hard on the students. The person who is unable to meet his original goal may feel inadequate psychologically after dropping out. He or she must now determine another direction, whether it be in education or in the work force. Often the students remaining in their chosen profession are affected by their peers' failure to remain in the program. This can have a depressing effect upon all students.

A method to reduce this early attrition may not only help the Radiologic Technology Program at Spartanburg Technical College, but other institutions, as well. The determination and utilization of Cognitive Style Mapping may be one of the answers to the high dropout rate in the Radiologic Technology profession. Cognitive Style Mapping may be helpful in dealing with the problem of getting to know the students prior to acceptance into a program.

Review of Related Literature

College educators possess a great deal of information about their students, including high school and college grades, scores on standardized achievement tests, aptitude test data, and vocational preference inventories. Most of this information is of a cognitive nature and, because it accounts for much of the variance in learner achievement, is very valuable. Recent studies, however, show that noncognitive or affective factors (those governing the feelings of a person) also account for differences in learner achievement.[6] Such affective information includes anxiety and locus of control (i.e. external - outside authority, or internal - one's self). Some researchers believe that affective information will eventually be shown to account for the major portion of the total variance in learner achievement.

Traditional education can be characterized as individualized for the teacher but not the student. The students are expected to adjust their learning pace and abilities to whatever their particular teacher can do or chooses to do. Benjamin Bloom, however, in his Learning for Mastery text says:

> "Most students (perhaps more than ninety percent) can master what we have to teach, and it is the task of instruction to find the means which will enable our students to master the subject under consideration."[7]

It may be that most attempts to design and deliver instruction for mastery fail because noncognitive factors receive little or no attention in planning college instruction.

For colleges to be efficient and successful, students should succeed. Many institutions are now searching for ways to help students learn more in less time, achieve academic success, and formulate goals

for future aspirations. According to Lee, community colleges are full of promise and offer to more Americans, in more areas and of more ages than any other segment of higher education, an opportunity to start an academic career, to increase occupational skills, to enrich the quality of their lives, and generally to multiply their educational options.[8]

Community college students tend to be different from their counterparts at four-year institutions. On the average they are older and were in non-college-bound tracks in high school. Many are training for specific careers, others are part-time students holding full-time jobs. Once these students have made the decision to return to school, what awaits them? How much is known about the basic skills necessary for survival? How much is known about the diversity of the students and how that diversity affects their chances for success? Smith and Standal believe that, unfortunately, not much is known about any of these variables.[9]

It is reported by Medsker and Tillery that approximately one-third of the students entering college find themselves in limbo and soon on their way out of college. This occurs because they are placed in programs they cannot handle; they are turned off by instruction that is irrelevant to their interests, and some are overwhelmed by financial pressure.[10]

In the opinion of Gilliland, many people make career choices based on shaky evidence due to the lack of an adequate career planning program. He feels that the dissatisfaction expressed is probably due to poor career choices.[11]

As expressed by Mood, more attention should be given to career planning. Career planning should do more than provide information about careers. Each student should be counseled individually to assure that

his choice will match his personality, his abilities, and his needs.[12]

According to Lee there are three basic problems faced by students entering college:[13]

1. Most students experiencing difficulty in college have in common a poor self-image, or at least an inaccurate self-concept;

2. Students not only learn at different rates, but also in different ways;

3. A large percentage of the enrolling freshman are undecided, confused, and frustrated about the occupation they plan to follow.

Henderson outlines two phases to the student problems in higher education which reinforces what others have found. One phase involves defining the career for which the student should prepare, and the other phase includes the student preparing himself for other aspects of his life including his use of leisure time, his family life, his work within his community, and his responsibility as a member of organized society.[14]

Burns feels that serious attention should be focused on the needs of the individual student. Student goals and aspirations, his cultural and educational background, and his interests and learning style should be given particular attention.[15]

As colleges attempt to build programs for students based on their needs, Bruner's philosophy is that the institution will have a better chance of surviving if all students are assisted in achieving their optimum intellectual level.[16]

Correlational studies at Longview Community College and the University of Missouri-Columbia indicate that there are at least five learning styles related to college achievement. Students' affiliation with teachers, organizational structure, independence, attitude toward

competition, and expectations are related to achievement and that course content and the delivery system of this content are probably powerful predictors of success.[17]

Cognitive Style is a unique concept for describing an individual's mode of behavior in searching for meaning within the educational institution as well as his outside environment. It is a way that a person comes to know about his surroundings and how he relates to them. Educational cognitive style measures the way that the person tends to seek meaning. Cognitive styles are influenced by the ways in which the individual derives meaning from symbols related to his experience and his surroundings; the influences of family, friends, and his own individuality in these meanings; and the kind of reasoning processes used.

The term cognitive styles is general and encompasses all individual variations in the cognitive functioning that do not fit in the conventional categories of abilities. Educators are accustomed to dealing with constructs of verbal and numerical ability, creativity, emotional maturity, and motivation. Unlike these constructs, the basis of cognitive styles has penetrated the educational scene to only a small degree. Until the last ten to fifteen years, there was almost a total lack of articulation between the psychological study of cognition and educational research. Three major developments have occurred within the last fifteen years to bring education and psychology closer together. First, many experimental psychologists have turned their attention to the study of cognitive processes in ways that are directly related to educational issues. Second, there has been an upsurge of studies in cognitive development as inspired by Jean Piaget with efforts being made to match the developmental stage of the individual to the content and method of

instruction. Third, there has been a renewal of interest in individual differences.[18]

Predictions can be based on a cluster of meaningful interrelated characteristics as outlined by the individual's cognitive style. Each learner has his own individual style of learning. This utilization of knowledge concerning individual learning styles and application of it to the development of instructional strategies, counseling technique, and placement procedures as well as in all other phases of education should be the task for the educator.[19]

There are a variety of appropriate methods for determining the cognitive style of a student. The mathematical method encompasses the uses of: 1) a performance battery or 2) a preference inventory. A battery of tests and self-assessment instruments are evaluated to determine the person's cognitive style of learning. The use of a single self-assessment questionnaire followed by student input for verification is another method for mathematical mapping. Empirical mapping is accomplished through: 1) controlled observation or 2) an interview process with the student. Behaviors, skills, relationships, and sensory data can be derived through mapping by observation. The interview process involves questions and answers, as well as useful materials, such as pictures, manipulative materials, sorting items, etc. Mapping may be done formally or informally, by counselor, instructor, or paraprofessional in a structured or unstructured setting. Although institutions may offer advice for practical experience to another institution wishing to initiate cognitive style mapping, each institution must develop a unique program for mapping students of their program.[20]

In the preference inventory, the measurement of cognitive style is

accomplished by administering a series of tests to the individual. Because there are no right or wrong answers, the tests are more properly referred to as questionnaires which seek to elicit preferred methods of receiving and processing information and factors which enter into any person's ability to receive and process information efficiently. The results of this process is the creation of a cognitive style map which gives the person mapped an insight into the conclusions to be drawn from his own expression of preferences. This insight may take the form of advising the person as to optimal ways of seeking information. It may assume the form of presenting the person with strategies of coping with ways of dealing with information which is not available in the individual's optimal learning style. As a science, it is still in its infancy. Although there is much research to be carried on, the conclusions thus far indicate that there is more to the theory than mere supposition or fantasy.

Currently there are approximately ten to fifteen cognitive style inventory models. Only a few of the models are operable in the teaching-learning process. The focus of this research paper will be on one model developed by Dr. Joseph Hill. The Hill model is an edumetric device composed of twenty-eight elements that are involved in the learning process.

Another inventory, the Learning Preference Inventory, was constructed in 1974 to identify preferred modes of learning by health professional students and practitioners. It was first used to access the learning preferences of students in six allied health professions. Two other inventories; one by Kolb, and one by Friedman and Stritter; were used with health professionals, also. Plovnick used Kolb's inventory to

determine the influence of medical students' learning styles on their choice specialty. His results indicated that different medical careers are associated with different learning styles.[21] Wunderlich and Gyerde replicated Plovnick's work. Their findings suggest no association between learning styles and specialty choice medicine.[22]

A number of other studies have been completed, correlating cognitive style and learning performance. Rezler and Rezmovic administered the Learning Preference Inventory to one hundred fifty-nine allied health students from six curricula. They found that their inventory was a useful tool whereby health profession educators could identify the learning preferences of their students.[23] According to F. Brooks Sanders, associated with Broome Community College, the correlation between cognitive style and educational technology does result in a matching of information processing styles.[24] Studies done by Boozer,[25] Rafeld and Fraas,[26] Jonassen,[27] and Letteri[28] all support learning style preference inventories for valuable information regarding relationships between cognitive styles and learning performance.

The model presented by Hill is generally applicable in education at any level and in any area. Valler states that these maps show teachers quickly and with reasonable accuracy what their audience is like, thus streamlining the process of selecting the teaching method most likely to work with the particular audience.[29]

The feasibility of increasing teaching effectiveness and personalization of instruction utilizing educational cognitive style mapping has been demonstrated in numerous projects and dissertations. According to Atkins, in order for cognitive style mapping procedures to be completely effective in any particular educational situation, the involve-

ment and commitment of both the administration and faculty are necessary.[30]

Like many other authors, Bowman, et al feels that through the use of cognitive style mapping educators can determine which students can and do learn from TV, programmed instruction, group work, textbooks, etc. The aim of the teacher is to diagnose the style of the student, determine his strengths, and begin to instruct him, utilizing media methods, and materials which will capitalize on his strengths to augment his weaknesses and ensure success.[31]

Utilization of cognitive style mapping at Fox Valley Technical Institute, Appleton, Wisconsin is a prescriptive approach to classroom management used on a day-to-day basis. It helps educators spot and avoid potential learning problems, aids in matching students to courses, and reduces dropouts. Two aspects of prescriptions are addressed:[32]

1) The coping aspect which helps the student to succeed often by changing the process to match his strengths;

2) The developmental aspect which deals with changing the student in an effort to upgrade his skills.

A paper presented at the annual meeting of the American Educational Research Association by Gary L. Long describes a study identifying the cognitive skills related to academic performance in five career areas. The study indicated that there are certain cognitive styles identified with specific careers.[33]

According to Keyser a study was done at Mount Hood Community College concerning retention rates. It revealed that a treatment group with cognitive style mapping achieved a higher retention rate from Fall term to Spring term (67 percent) than did the non-treatment group (43 percent). This indicates that there is a direct correlation between cognitive

mapping and higher retention rates.[34]

Rose and Xenos (1975) developed various cognitive styles required in different occupational areas to provide a basis for guiding students toward occupational areas which closely match their cognitive styles.[35] According to this study students whose cognitive styles do match with specific occupational cognitive styles will:

1) be more successful;
2) be more interested;
3) be less likely to dropout;
4) save time and energy.

Volk was successful in developing a typical cognitive profile of the entering nursing student who succeeds in the two-year nursing program. He also presented the symbolic elements unique to the unsuccessful nursing student.[36]

Because of the lack of available literature there has apparently been little research done concerning the results of matching individual cognitive styles with the prescribed occupational styles in an effort to reduce the number of early dropouts. There is evidence, however, showing positive correlation between an individual's cognitive style and the occupational cognitive style. This type of information may prove valuable in other areas of occupational education.

Conceptual Framework

This study was done to determine if there is a typical cognitive profile of students which could indicate potential success in a two year program of Radiologic Technology. It attempted to identify the symbolic elements unique to the successful and the unsuccessful student.

It was also done to identify the symbols held in common by both the successful and unsuccessful student and the symbols that were negligible on the cognitive profile of both groups in this study. Through the use of this typical cognitive profile an attempt was made to determine which of these students were most likely to become successful Radiologic Technologists.

Assumptions

Several assumptions concerning the cognitive style mapping process were made before the study was begun. One assumption was that all students whose cognitive styles were used carefully and truthfully answered the questions on the questionnaire. Another assumption was that a certain degree of the successful student's cognitive style may have been augmented through the two years because of the various delivery systems that the educators may have used to help improve the student's weaknesses. A third assumption made was that the person who hand-scored the profile maps had been effectively trained in the scoring process.

Definitions

Cognitive Style - The way a person comes to know about his surroundings and how he relates to them.

Educational Cognitive Style - The way a student tends to seek meaning.

Educational Cognitive Map - A word picture of an individual indicating his strengths and weaknesses on how he seeks meaning from his environment and personal experience. This is accomplished through the use of a questionnaire which seeks to elicit preferred methods of receiving and processing information efficiently.

Educational Science of Cognitive Style - A Cartesian product of four sets which are:

1. symbols and their meanings;
2. cultural determinants of the meaning of symbols;
3. modalities of inference;
4. biochemical and electrophysiological aspects of the memory function concern.

Hill Cognitive Style Mapping Inventory - A questionnaire developed by Joseph Hill composed of a variety of statements to which the student is asked to respond with "usually," "sometimes," or "seldom." A careful analysis of this data leads to the word picture of the individual.

Symbols and their meanings:

There are two types of symbols, theoretical (e.g. words and numbers) and qualitative (e.g. sensory, programmatic, and codes), created and used by individuals to acquire knowledge and derive meaning from their environments and personal experiences. Theoretic symbols differ from qualitative symbols in that the theoretical symbols present to the awareness of the individual something different from that which the symbols are. Words and numbers are examples of theoretical symbols. Qualitative symbols are those symbols which present and then represent to the awareness of the individual that which the symbol is. (Feelings, commitments, and values are some examples of the meanings conveyed by the qualitative symbols.)

T (VL) - Theoretical Visual Linguistic - visual perception

T (AL) - Theoretical Auditory Linguistic - hearing words

T (VQ) - Theoretical Visual Quantitative - visual perception number

T (AQ) - Theoretical Auditory Quantitative - hearing numbers

Q (A) - Qualitative Auditory - sound other than words

Q (O) - Qualitative Olfactory - smell

Q (S) - Qualitative Savory - taste

Q (T) - Qualitative Tactile - touch

Q (V) - Qualitative Visual - sight other than words

Q (P) - Qualitative Proprioceptive - coordination

Q (CEM) - Qualitative Code Empathic - empathy

Q (CES) - Qualitative Code Esthetic - creative

Q (CET) - Qualitative Code Ethic - commitment to set of values

Q (CH) - Qualitative Code Histrionic - staged behavior

Q (CK) - Qualitative Kinesics - body language

Q (CKH) - Qualitative Kinesthetic - motor skills

Q (CP) - Qualitative Proxemics - capacity to judge social distance

Q (CS) - Qualitative Synnoetics - knowledge of oneself

Q (CT) - Qualitative Transactional - leadership

There are three cultural determinants of the meaning of symbols. They are:

I - Individual

F - Family

A - Associates

The third set of the Cartesian product forming the map of cognitive style includes elements which indicate the individual's modality of inference. They are:

M - Magnitude (categorical reasoning)

D - Difference (one to one contrast)

R - Relationship (multiple input)

L - Appraisal (uses all three of the above to analyze)

K - Deductive (logical proof)

The cognitive style elements can occur in varying degrees of strength and have been categorized as follows:

Major - score falling between 27 and 40

A major indicates that a person prefers to use the characteristic and he/she exhibits that characteristic much of the time. A major should indicate a preferred style of learning.

Minor - score falling between 16 and 26

A minor indicates that the person uses the characteristic being described. However, he/she probably does not derive as much meaning through one of the "minor" items as he/she does through "major" items.

Negligible - score falling between 0 and 15

A negligible indicates that the person derives little, if any, meaning from that characteristic. He/she prefers not to learn in that manner.

The Successful Student - The student who completed the twenty-four month course of study and passed the national registry examination.

The Unsuccessful Student - The student who did not complete the twenty-four month course of study or the student who did complete the course of study but did not pass the national registry examination.

Hypothesis

H_1 There are significant differences between the cognitive style maps of the successful Radiologic Technology student and the unsuccessful Radiologic Technology student.

H_0 There are no significant differences between the cognitive style maps of the successful Radiologic Technology student and the unsuccessful Radiologic Technology student.

Limitations

Several limitations were placed upon this study. They are:

1) This study was limited because there were only fifty-two cognitive style maps available with which to do the statistical analyses. A larger quantity of maps could change the results of this study.

2) The person who hand-scored the profile maps was assumed to be effectively trained in the scoring process.

II. METHODS AND PROCEDURES

Data Sources

Fifty-two student records were reviewed to analyze data for this study. These records included the entering Radiologic Technology students in the Fall Quarters of 1977, 1978, and 1979. The students entering the program in 1980 and 1981 were not included because they have not yet completed this twenty-four month course. The specific students were not identified by name in this study.

Data Gathering Instrument

The Hill Cognitive Style Mapping Inventory was revised to Southern vernacular by Spartanburg Technical College faculty and staff with consultation from Tom Volk, Oakland Community College. It has a 6.0 reading level, requires approximately forty-five minutes to administer, and can be hand-scored.

Analytical Technique

The ordinal data was examined through three different statistical analyses to determine the difference in the criteria measured. All twenty-eight of the independent variable symbols on the Cognitive Style Map were used. Each symbol was grouped as negligible, minor, or major by recording the student's individual score for that symbol. The other dependent variables were identified by placing the specific student in one of the following two categories: 1) the successful student and 2) the unsuccessful student (as described on page 19).

The first analytical technique done was a frequency distribution

comparing the number of successful students, ranking as major, minor, or negligible with the number of unsuccessful students, also ranking as major, minor, or negligible. This was done for each of the twenty-eight independent variables. Cross tabulations were then completed between these variables of nonparametric statistics with the results being determined by Pearson's Correlation Coefficient at the .05 level of significance. The third analysis done was a t-test for each independent variable also at the .05 level of significance.

III. RESULTS

In an effort to test the hypotheses frequency distributions, Pearson's Correlation Coefficient, and t-tests were completed on the fifty-two available individual maps of Radiologic Technology students. Profiles illustrating the strengths and weaknesses of the successful and unsuccessful student were not assembled because of the nonsupporting results indicated in the statistical analyses.

A frequency distribution was completed on each of the twenty-eight symbols located on each student's cognitive style map. The results of this study are shown in Tables 1 through 28. The results indicated that the number of successful and unsuccessful students, grouped as major, minor, or negligible, were fairly evenly distributed throughout. No significant correlation was established. For example, of the twenty-six successful students twenty-one ranked as major, five as minor and none as negligible. Of the twenty-six unsuccessful students twenty ranked as major, six as minor, and none as negligible.

FREQUENCY DISTRIBUTION OF EACH SYMBOL LOCATED ON COGNITIVE STYLE MAPS

TABLE 1

TABLE OF T(AL) BY S - U

Frequency Percent	S*	U*
Major	21 40.38	20 38.46
Minor	5 9.62	6 11.54
Negligible	0 0.00	0 0.00
TOTAL	26 50.00	26 50.00

TABLE 2

TABLE OF T(AQ) BY S - U

Frequency Percent	S*	U*
Major	9 17.31	10 19.23
Minor	17 32.69	16 30.77
Negligible	0 0.00	0 0.00
TOTAL	26 50.00	26 50.00

TABLE 3

TABLE OF T(VL) BY S - U

Frequency Percent	S*	U*
Major	18 34.62	18 34.62
Minor	7 13.46	8 15.38
Negligible	1 1.92	0 0.00
TOTAL	26 50.00	26 50.00

*S = Successful Student

TABLE 4

TABLE OF T(VQ) BY S - U

Frequency Percent	S*	U*
Major	17 32.69	19 36.54
Minor	9 17.31	7 13.46
Negligible	0 0.00	0 0.00
TOTAL	26 50.00	26 50.00

*U = Unsuccessful Student

FREQUENCY DISTRIBUTION OF EACH SYMBOL LOCATED ON COGNITIVE STYLE MAPS

TABLE 5

TABLE OF Q(A) BY S* - U*

Frequency Percent	S*	U*
Major	23 44.23	20 38.46
Minor	3 5.77	6 11.54
Negligible	0 0.00	0 0.00
TOTAL	26 50.00	26 50.00

TABLE 6

TABLE OF Q(O) BY S* - U*

Frequency Percent	S*	U*
Major	20 38.46	24 46.15
Minor	6 11.64	2 3.85
Negligible	0 0.00	0 0.00
TOTAL	26 50.00	26 50.00

TABLE 7

TABLE OF Q(S) BY S* - U*

Frequency Percent	S*	U*
Major	26 50.00	26 50.00
Minor	0 0.00	0 0.00
Negligible	0 0.00	0 0.00
TOTAL	26 50.00	26 50.00

TABLE 8

TABLE OF Q(T) BY S* - U*

Frequency Percent	S*	U*
Major	26 50.00	24 46.15
Minor	0 0.00	2 3.85
Negligible	0 0.00	0 0.00
TOTAL	26 50.00	26 50.00

*S = Successful Student

*U = Unsuccessful Student

FREQUENCY DISTRIBUTION OF EACH SYMBOL LOCATED ON COGNITIVE STYLE MAPS

TABLE 9

TABLE OF Q(V) BY S* -U*

Frequency Percent	S*	U*
Major	21 40.38	21 40.38
Minor	5 9.62	5 9.62
Negligible	0 0.00	0 0.00
TOTAL	26 50.00	26 50.00

S* = Successful Student

TABLE 10

TABLE OF Q(P) BY S* -U*

Frequency Percent	S*	U*
Major	12 23.08	16 30.77
Minor	13 25.00	10 19.23
Negligible	1 1.92	0 0.00
TOTAL	26 50.00	26 50.00

U* = Unsuccessful Student

TABLE 11

TABLE OF Q(CEM) BY S* -U*

Frequency Percent	S*	U*
Major	24 46.15	26 50.00
Minor	2 3.85	0 0.00
Negligible	0 0.00	0 0.00
TOTAL	26 50.00	26 50.00

S* = Successful Student

TABLE 12

TABLE OF Q(CES) BY S* -U*

Frequency Percent	S*	U*
Major	23 44.23	26 50.00
Minor	3 5.77	0 0.00
Negligible	0 0.00	0 0.00
TOTAL	26 50.00	26 50.00

U* = Unsuccessful Student

FREQUENCY DISTRIBUTION OF EACH SYMBOL LOCATED ON COGNITIVE STYLE MAPS

TABLE 13

TABLE OF Q(CET) BY S* - U*

Frequency Percent	S*	U*
Major	25 48.08	24 46.15
Minor	1 1.92	2 3.85
Negligible	0 0.00	0 0.00
TOTAL	26 50.00	26 50.00

TABLE 14

TABLE OF Q(CH) BY S* - U*

Frequency Percent	S*	U*
Major	11 21.15	15 28.85
Minor	15 28.85	10 19.23
Negligible	0 0.00	1 0.00
TOTAL	26 50.00	26 50.00

TABLE 15

TABLE OF Q(CK) BY S* - U*

Frequency Percent	S*	U*
Major	21 40.38	21 40.38
Minor	5 9.62	5 9.62
TOTAL	26 50.00	26 50.00

TABLE 16

TABLE OF Q(CKH) BY S* - U*

Frequency Percent	S*	U*
Major	21 40.38	23 44.23
Minor	3 5.77	3 5.77
TOTAL	26 50.00	26 50.00

S* = Successful Student

*U = Unsuccessful Student

FREQUENCY DISTRIBUTION OF EACH SYMBOL LOCATED ON COGNITVE STYLE MAPS

TABLE 17

TABLE OF Q(CP) BY S* - U*

Frequency Percent	S*	U*
Major	24 46.15	25 48.08
Minor	2 3.85	1 1.92
Negligible	0 0.00	0 0.00
TOTAL	26 50.00	26 50.00

TABLE 18

TABLE OF Q(CS) BY S* - U*

Frequency Percent	S*	U*
Major	23 44.23	25 48.08
Minor	3 5.77	1 1.92
Negligible	0 0.00	0 0.00
TOTAL	26 50.00	26 50.00

TABLE 19

TABLE OF Q(CT) BY S* - U*

Frequency Percent	S*	U*
Major	14 26.92	15 28.85
Minor	12 23.08	11 21.15
TOTAL	26 50.00	26 50.00

TABLE 20

TABLE OF Q(CTM) BY S* -U*

Frequncy Percent	S*	U*
Major	22 42.31	21 40.38
Minor	4 7.69	5 9.62
TOTAL	26 50.00	26 50.00

S* = Successful Student

U* = Unsuccessful Student

FREQUENCY DISTRIBUTION OF EACH SYMBOL LOCATED ON COGNITIVE STYLE MAPS

TABLE 21

TABLE OF A BY S* - U*

Frequency Percent	S*	U*
Major	16 30.77	15 28.85
Minor	9 17.31	11 21.15
Negligible	1 1.92	0 0.00
TOTAL	26 50.00	26 50.00

TABLE 22

TABLE OF F BY S* - U*

Frequency Percent	S*	U*
Major	15 28.85	17 32.69
Minor	9 17.31	9 17.31
Negligible	2 3.85	0 0.00
TOTAL	26 50.00	26 50.00

TABLE 23

TABLE OF I BY S* - U*

Frequency Percent	S*	U*
Major	24 46.15	19 36.54
Minor	2 3.85	7 13.46
Negligible	0 0.00	0 0.00
TOTAL	26 50.00	26 50.00

TABLE 24

TABLE OF M BY S* - U*

Frequency Percent	S*	U*
Major	23 44.23	21 40.38
Minor	3 5.77	5 9.62
Negligible	0 0.00	0 0.00
TOTAL	26 50.00	26 50.00

S* = Successful Student

U* = Unsuccessful Student

FREQUENCY DISTRIBUTION OF EACH SYMBOL LOCATED ON COGNITIVE STYLE MAPS

TABLE 25

TABLE OF D BY S* - U*

Frequency Percent	S*	U*
Major	11 21.15	14 26.92
Minor	15 28.85	12 23.08
Negligible	0 0.00	0 0.00
TOTAL	26 50.00	26 50.00

TABLE 26

TABLE OF R BY S* - U*

Frequency Percent	S*	U*
Major	22 42.31	19 36.54
Minor	4 7.69	7 13.46
Negligible	0 0.00	0 0.00
TOTAL	26 50.00	26 50.00

TABLE 27

TABLE OF L BY S* - U*

Frequency Percent	S*	U*
Major	26 50.00	24 46.15
Minor	0 0.00	2 3.85
Negligible	0 0.00	0 0.00
TOTAL	26 50.00	26 50.00

TABLE 28

TABLE OF K BY S* - U*

Frequency Percent	S*	U*
Major	21 40.38	20 38.46
Minor	5 9.62	6 11.54
Negligible	0 0.00	0 0.00
TOTAL	26 50.00	26 50.00

S* = Successful Student

U* = Unsuccessful Student

Pearson's Correlation Coefficient compared each individual symbol with the successful and unsuccessful student at a .05 degree of significance. These results are tabulated in Table 29. The results indicate that there are correlations between only two symbols, Q(CET) and Q(CP), and the successful student.

TABLE 29

COMPARISON OF CSM SYMBOLS AND SUCCESSFUL/UNSUCCESSFUL STUDENTS UTILIZING PEARSON'S CORRELATION COEFFICIENT

Variable	Correlation Coefficient	Level of Significance
T(AL)	0.10097	0.4763
T(AQ)	-0.03465	0.4625
T(VL)	-0.10415	0.2091
T(VQ)	-0.17709	0.2091
Q(A)	-0.03480	0.8065
Q(O)	-0.17203	0.2226
Q(S)	-0.19759	0.1603
Q(T)	0.13258	0.3488
Q(V)	-0.10753	0.4480
Q(P)	-0.21542	0.1251
Q(CEM)	-0.20720	0.1405
Q(CES)	-0.21418	0.1273
Q(CET)	-0.26222	0.0504
Q(CH)	-0.22619	0.1069
Q(CK)	-0.00520	0.9708
Q(CKH)	-0.10038	0.4789
Q(CP)	-0.30390	0.0285
Q(CS)	-0.03281	0.8174
Q(CT)	-0.03475	0.8063
Q(CTM)	-0.01446	0.9190
A	0.07329	0.6056
F	-0.05633	0.6916

TABLE 29 (continued)

Variable	Correlation Coefficient	Level of Significance
I	0.21341	0.1287
M	0.01398	0.9216
D	-0.00465	0.9739
R	0.00488	0.9726
L	-0.05052	0.7221
K	0.08219	0.5624

**Significance at .05 level

Finally, a t-test was done to retest each variable at the .05 degree of significance. Table 30 indicates the results of this t-test. The results show that there is a significant correlation between two symbols, Q(CET) and Q(CP), and the successful student. No correlation was found between the remaining twenty-six symbols and the successful student.

TABLE 30

COMPARISON OF CSM SYMBOLS AND SUCCESSFUL/UNSUCCESSFUL STUDENTS UTILIZING T-TEST

Variable	S*-U*	N	Mean	Std Dev	Std Error	T	t
T(AL)	S	26	30.962	4.651	0.912	0.7176	0.4763
	U	26	30.000	5.004	0.981	0.7176	0.4763
T(AQ)	S	26	25.385	3.710	0.728	-0.2451	0.8074
	U	26	25.654	4.195	0.823	-0.2451	0.8074
T(VL)	S	26	28.577	5.800	0.823	-0.7405	0.4628
	U	26	29.615	4.916	0.823	-0.7405	0.4625
T(VQ)	S	26	27.115	5.389	1.056	-1.2723	0.2100
	U	26	28.731	3.591	0.705	-1.2723	0.2091
Q(A)	S	26	30.846	4.027	0.790	-0.2463	0.8065
	U	26	31.154	4.937	0.968	-0.2463	0.8065
Q(O)	S	26	30.846	4.896	0.0960	-1.2349	0.2227
	U	26	32.500	4.760	0.9336	-1.2349	0.2226
Q(S)	S	26	34.538	2.642	0.5181	-1.4253	0.1605
	U	26	35.692	3.172	0.6221	-1.4253	0.1603
Q(I)	S	26	35.154	3.749	0.7352	0.0458	0.3491
	U	26	34.000	4.964	0.9735	0.9458	0.3488

S* = Successful Student U* = Unsuccessful Student ** Significance at .05 level

TABLE 30 (continued)

Variable	S*-U*	N	Mean	Std Dev	St Error	T	t
Q(V)	S	26	31.115	4.546	0.8915	-0.7648	0.4480
	U	26	32.115	4.877	0.9564	-0.7648	0.4480
Q(P)	S	26	27.077	5.600	1.0981	-1.5599	0.1253
	U	26	20.308	4.671	0.9161	-1.5599	0.1251
Q(CEM)	S	26	32.385	4.346	0.852	-1.4976	0.1406
	U	26	34.077	3.783	0.742	-1.4976	0.1406
Q(CES)	S	26	33.423	3.635	0.713	-1.5505	0.1273
	U	26	34.808	2.743	0.538	-1.5505	0.1273
Q(CET)	S	26	32.346	3.698	0.725	-1.9214	0.0504
	U	26	34.077	3.664	0.718	-1.9214	0.0504
Q(CH)	S	26	25.770	3.513	0.689	-1.6420	0.1079
	U	26	27.846	5.409	1.061	-1.6420	0.1069
Q(CK)	S	26	30.077	3.939	0.772	-0.0368	0.9708
	U	26	30.115	3.593	0.705	-0.0368	0.9708
Q(CKH)	S	26	30.770	7.743	1.518	-0.7134	0.4796
	U	26	32.038	4.728	0.927	-0.7134	0.4796
Q(CP)	S	26	31.808	3.250	0.637	-2.2556	0.0286
	U	26	34.000	3.742	0.734	-2.2556	0.0285
Q(CS)	S	26	33.038	4.171	0.818	-0.2321	0.8174
	U	26	33.308	4.193	0.822	-0.2321	0.8174
Q(CT)	S	26	26.962	4.331	0.849	-0.2459	0.8068
	U	26	27.269	4.687	0.919	-0.2459	0.8068

S* = Successful Student U* = Unsuccessful Student **Significance at .05 level

TABLE 30 (continued)

Variable	S*-U*	N	Mean	Std Dev	St Error	T	t
Q(CTM)	S	26	32.731	5.590	1.096	-0.1022	0.9190
	U	26	32.885	5.256	1.031	-0.1022	0.9190
A	S	26	27.269	5.532	1.085	0.5196	0.6057
	U	26	26.538	4.536	0.895	0.5196	0.6056
F	S	26	28.000	6.991	1.371	-0.3990	0.6919
	U	26	28.654	4.578	0.898	-0.3990	0.6919
I	S	26	31.923	4.049	0.794	1.5446	0.1293
	U	26	29.845	5.533	1.085	1.5446	0.1287
M	S	26	30.577	3.523	0.691	0.0989	0.9217
	U	26	30.462	4.794	0.940	0.0989	0.9216
D	S	26	27.423	4.291	0.842	-0.0329	0.9739
	U	26	27.462	4.150	0.814	-0.0329	0.9739
R	S	26	31.038	3.693	0.724	0.0345	0.9726
	U	26	31.000	4.317	0.847	0.0345	0.9726
L	S	26	34.538	3.467	0.680	-0.3577	0.7223
	U	26	34.962	4.935	0.968	-0.3577	0.7221
K	S	26	30.769	4.633	0.909	0.5831	0.5627
	U	26	30.115	3.351	0.657	0.5831	0.5624

S* = Successful Student U* = Unsuccessful Student **Significance at .05 level

IV. SUMMARY AND CONCLUSIONS

As indicated in the Conceptual Framework, one of the purposes of this study was to develop a typical cognitive profile of both the successful and unsuccessful Radiologic Technology student. After reviewing the collected data and testing for correlations between the various symbols and the successful and unsuccessful student, it was not possible to develop two profiles that were significantly different from one another. However, it was found that there were significant correlations between two of the twenty-eight symbols and the successful student. These two symbols are Q(CET) and Q(CP). Because of the lack of significant differences with all symbols, no profiles were constructed through the use of the Cognitive Style Map.

Although no profiles were constructed, the two symbols which correlated with the successful student can be of value to the Radiologic Technology educator and the student. The symbol, Q(CET), relates to a person's commitment to a set of values. In all health professions it is extremely important that the professional worker display good ethical conduct. He should display good interpersonal relationships with the patients, the doctors, and his co-workers. This symbol also relates to the person who possesses the ability to complete a task. The student with a major Q(CET) most likely represents the student who will complete the program and become a successful health professional.

The other major symbol which relates to the successful student is Q(CP). Q(CP) indicates a person's ability to accurately judge social distances. For example, a Radiologic Technologist should be able to

relate well with highly educated health professionals (i.e. doctors, nurses, etc.) as well as the lay public, and his peers. The inability to cope with the close patient and physician relationships was cited as being one of the reasons why students fail to complete this program.

Another object of this study was to attempt to predict the success of Radiologic Technology students by using a cognitive profile developed from the cognitive style mapping inventory. Because there were twenty-eight independent variables and only two of these variables correlated with the successful student, it was not felt that a cognitive profile could be established for the purpose of accepting a student into the program or rejecting a student from the program. However, these symbols could serve as guidelines in the selection of potentially successful Radiologic Technology students. A relevant comparison of the individual student map and the two symbols, Q(CP) and Q(CET) should be completed. The presence of these two symbols in a student's profile could help indicate a successful potential. The absence of these two symbols would indicate a need for the student to strengthen these areas.

Because of these results the null hypothesis which stated, "There are no significant differences between the cognitive style maps of the successful Radiologic Technology student and the unsuccessful Radiologic Technology student," must be accepted and H_1 is rejected.

During the search of the literature, various authors indicated that it is possible to construct appropriate student profiles for success in specific occupations or carreers. This study, however, did not prove this to be true of the students surveyed with this Cognitive Style Map in the Radiologic Technology program at this time. Certain limitations of this study may have proven to hinder the development of the profiles.

A later study including more students after this Cognitive Style Mapping program has been in use for a longer period of time may alter the results of this study. A careful examination of the way in which the inventories are administered and scored could also change the results in the future. Perhaps the purpose of the inventory was not explained to the student prior to answering the questions. The environment in which this inventory was given may have not been conducive to good concentration. A more appropriate inventory for health professionals may be found. Finally, stressing to the students the need for careful consideration and truthful answering of each question may enable the construction of appropriate profiles.

Another major factor which clearly affected the results is the admission process. Because of the problem of high attrition rates, students are carefully selected for this program. Some of the requirements include: 750 or higher on the ACT, at least a B average in high school, prerequisites of chemistry and algebra. It is not until after the students have been accepted that their cognitive styles are mapped. At this point only students with similar academic backgrounds are completing the inventory. This probably accounts for the inventory similarity. Perhaps if an effort is to be made to develop profiles of the successful and unsuccessful student in the future, another tool in conjunction with Cognitive Style Mapping should be utilized.

Although it was found that no statistically significant difference existed between the successful and unsuccessful student, this cognitive style inventory should be used after the acceptance of students to help determine each individual student's needs and serve a definite counseling and advising purpose. Certain weaknesses may be recognized early.

Through special attention, these weaknesses may be augmented. By using the inventory a closer relationship is possible between the instructor and student early in the student's career, because of the increased personalization of instruction.

The results of this research is of great value to the Radiologic Technology educator even though the null hypothesis was accepted. Two valuable symbols were identified through statistical analyses as being indicators of success in the Radiologic Technology program. These two symbols have always been identified as being two very important aspects of the competent health care professional. They can serve as guidelines in the selection of potentially successful students. Therefore, cognitive style mapping is a valuable guide for faculty and students use in the prescription for remedial, enrichment, and developmental studies as well as serving as an effective foundation instrument for advising and counseling.

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